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Sustainability Complexities in Supply Chains: a Qualitative Study utilizing Social Systems Theory

Alexander Neske[1]* | **Ilona Bordiyanu[2]** | **Christian Brauweiler[1]**

[1] Westsächsische Hochschule Zwickau University of Applied Sciences, Zwickau, Germany
[2] Kazakh-American Free University (KAFU), Ust-Kamenogorsk, Kazakhstan

Corresponding author:
*__Alexander Neske__ – M.Sc., Westsächsische Hochschule Zwickau University of Applied Sciences, Zwickau, Germany.
Email:alexander.neske@outlook.com

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Abstract

The purpose of this paper is to explore which sustainability complexities firms see in their supply chains. As supply chains consist of various actors and the consideration of sustainability requirements in supply chains adds to the complexity of the management of the supply chains, we apply the social systems theory as a theoretical framework enlighten inherent complexities. For investigating the research purpose, this study carried out multiple case studies with firms in the agriculture sector as these firms rely on the natural habitat and produce or source agricultural products face high expectations but also pressures from various actors. The interviewed firms were from textiles, beverages, coffee, food, non-food, cosmetics, ingredients and chemical branches. In total, this study conducted 26 semi-structured interviews with sustainability responsibles. The findings show, which different sustainability complexities firms in different branches see. By that, this study contributes to the literature as it is to the best of our knowledge the first utilizing social systems theory in the context of sustainable supply chain management. Second, for reducing sustainability complexities firms need to view and understand their relevant sustainability complexities first. Third, this paper contributes with managerial implications as firms can use our research as a starting point for identifying sustainability complexities and coping with them.

Keywords: Economic Sustainability, Supply Chain Management, Sustainability, Social Systems Theory, Complexity

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1. INTRODUCTION

Sustainable Supply Chain Management (SSCM) is increasingly important for industry and therefore recognized by both practice and academia (Taylor & Vachon, 2018). Historically complex and fragmented grown supply chains (Mena et al., 2013; Zhao et al., 2019) nowadays cause firms to manage sustainability not only on a first-tier level but also moving their focus to n-tier suppliers (Grimm et al., 2014; Grimm et al., 2016; Mena et al., 2013; Tachizawa & Wong, 2014; Wilhelm et al., 2016; Wilhelm et al., 2016).

For that reason, investigate sustainability issues in supply chains has started to attract academia. Authors like Wilhelm et al. (2016) investigate the role of suppliers in SSCM while others recognize existing challenges (Dou et al., 2018; Mena et al., 2013; Pathak et al., 2007; Sarkis & Qingyun Zhu, 2018). In particular, regarding the supply chain simplification in three tiers (Grimm et al., 2014; Wilhelm et al., 2016) already shows the underlying complexity in each tier (Mena et al., 2013; Pathak et al., 2007; Zhao et al., 2019). Managing supply chains though influencing and controlling suppliers (Gong et al., 2018; Sarkis et al., 2019; Tachizawa & Wong, 2014) is already a challenging task. Extending and managing sustainability in supply chains than further 'adds complexity to an already difficult problem' (Sarkis & Zhu, 2018; Sousa et al., 2019). This increased complexity derives from the perspective's sustainability inherits due to additional stakeholder requirements and involvements, extended performance objectives, as well as further needed business activities (Dou et al., 2018).

From that point of view, one of the biggest research gap in SSCM is the lack of understanding which sustainability complexities firms view and how to cope with them for further extending sustainability in supply chains (Sarkis & Zhu, 2018; Wilhelm et al., 2016). For filling this gap, we base our research on social systems theory to explore in a first step which sustainability complexities firm view. From our point of view, the social systems theory is suitable as it offers a complexity perspective on how systems (e.g., firms) view challenges (complexities) in the environment and respond to it (Luhmann, 1995). For that reason it is particularly suitable for investigating sustainability in supply chains and we therefore adopt it in our study for the following reasons: First, sustainability and its challenges in supply chains represents high environmental complexity as it inherits various dimensions like social, economic and ecologic sustainability pillars. Second, besides sustainability, supply chain management views different actors in a supply chain and investigates their connection. Third, viewing the environmental sustainability complexity (i.e. managing sustainability in supply chains) provides a first view on the internal and collaborative complexity needed for managing sustainability efficiently.

For investigating which sustainability complexities firms view, we adopt the social systems theory and developed a multiple-case study. The multiple-case study consists of cases all related to agricultural supply chains e.g., fruits, coffee, palm oil etc. That scope best provides us with a certain range of information but still enables to compare the cases and answering our research objective which sustainability complexities firms in their supply chains see.

By answering this, our research contributes to the literature in the following: First, to the best of our knowledge this might be the first attempt utilizing the social systems theory exploring sustainability complexities in supply chains. Second, by that, we enhance the understanding of sustainability complexities in supply chains and provide a starting point for further understand how firms manage and cope with sustainability complexities internally. Third, with our empirical study we extend the knowledge of the field and existing works (Gong et al., 2018; Jia et al., 2019; Tachizawa & Wong, 2014).

The paper is structured as following. First, we provide a brief overview of the Social Systems Theory. Afterwards, we explain our course of research for the empirical study in depth in the

methods part. Following the method part, we provide the within-case analysis. A discussion and cross-case analysis follows this section. A conclusion finalizes this paper.

2. LITERATURE REVIEW

In academic literature there is a long theoretical history exploring complexity, i.e. utilizing social systems theory. Social systems theory has roots in cybernetics (Ashby, 1957). A complex system is a situation with a large number of interacting elements, where it is difficult to state the properties of the system itself (Simon, 1962). A highly used analogy analyzing complexity is Wright's"fitness landscape" (1932). It was later developed by Luhmann (1995), analyzing different areas of social life. However, Kauffman's (1991) analogy to complexity argues that this landscape can be rugged depending on the systems' distribution of fitness values and the interdependences between the parts, meaning that the more complex a system is, the more fragmented will be the landscape (Reiskin et al., 1999; Yardley et al., 1992). According to Kauffman (1991) fitness landscapes are described by the number of elements characterizing the system and the number of interactions between the components. This concept has been widely applied in organizational design studies (Levinthal & Warglien, 1999), industrial collaboration (Schuh et al., 2006), supply chain management (Choi et al., 2001), and sustainable supply chains (Matos & Hall, 2007). Thereby, authors view systems from a different perspective. Choi et al. (2001) view it from an organizational point of view regarding the number of interactions between individuals, teams, or organizations.

Matos and Hall (2007), on the other hand, view the entity from a firm`s sustainable development policy with the firm`s sustainability indicators. In modern academic works, e.g., Hall et al. (2012) suggest that sustainable supply chains can be viewed from a complexity challenge perspective as they require the coordination of different actors in the supply chain regarding various sustainability elements like environmental and social sustainability indicators. However, academia regards complexity challenges through the interactions among organizations explained by social systems theory. In addition, scholars adopted social systems theory and utilized it from macro- to micro-level perspectives (Mohe & Seidl, 2011; Seidl & Becker, 2006).

In particular, social systems theory is greatly interested in organizational research (Adler et al., 2014). In literature, most studies of complex systems discuss them using simulations. An exception is Matos and Hall (2007), who draw on qualitative data to identify elements and interactions. Similarly, we rely on qualitative interview data identifying the complexities as elements in sustainable supply chains.

Central in Social Systems Theory is complexity. Complexity describes the number and the relationship of the elements of a system or the environment it consists of (Luhmann, 1995). Hence, the complexity increases as the number of the elements, the system consists of, increases. However, this increase in elements (i.e., complexity) could result from new requirements like sustainability indicators needed for managing the supply chain accordingly (Hall et al., 2012). To deal with these complexities firms need a sufficient amount of requisite variety, which could be understood as the measures available to a system (firm) (Ashby, 1957; Luhmann, 1995). Therefore, firms can either create internal complexity or utilize collaborative complexity available to them (Schneider et al., 2017). Internal complexity is understood as an organization's internal structures and processes (Daft & Lengel, 1986; Damanpour, 1996), whereas collaborative complexity is structures and processes between organizations (Schneider et al., 2017). Organizations can combine internal and collaborative complexity viewing environmental overlap and available collaborative complexity. Environmental overlap is the relevance to which an issue concerns more than one organization whereas available collaborative complexity is the requisite variety created by other organizations (Schneider et al., 2017).

From our point of view utilizing Social System Theory to understand sustainability complexities in supply chains is valuable for three reasons. First, sustainability and its challenges in supply chains represent high environmental complexity as it inherits various dimensions like social, economic, and ecologic sustainability pillars (Baumann-Pauly et al. 2013). Second, besides sustainability, supply chain management views different actors in a supply chain and investigates their connection (Yang et al., 2023; Muñoz-Torres et al., 2023) and third, viewing the environmental sustainability complexity (i.e. managing sustainability in supply chains) provides a first view on the internal and collaborative complexity needed for managing sustainability efficiently (Rasche et al. 2013; Baumann-Pauly et al. 2013; Reinecke et al., 2016). Therefore, by conceptualizing sustainability complexity utilizing social systems theory, we are interested in sustainable supply chain management of firms and, in particular, which sustainability complexities firms see in their respective supply chain (industry).

2. METHODOLOGY

More and more firms address sustainability issues in their supply chain management to stay competitive. This increases the complexity they must manage. So far, it remains unclear how firms can manage these sustainability complexities. For this end, we abductively explore which sustainability complexities firms face by conducting a multiple-case study (Locke et al., 2008).

A case-study approach in general allows first, to study a phenomenon in its natural setting (Dubois & Gadde, 2002; Dubois & Salmi, 2016; Meredith, 1998) and second it enables the researcher to understand the nature and complexity of the phenomenon itself (Benbasat et al., 1987; Stuart et al., 2002). Third, compared to large-scale-theory-testing methods, a case study additionally enables us to get closer to a theoretical construct and uncover the intrinsic relationships (Siggelkow, 2007). In order to ensure rigorousity in terms of validity and reliability, we applied quality measures proposed by Yin (2018). For a detailed overview of the quality measures, refer to Table 1.

TABLE 1. Quality measures for qualitative research

No.	Quality measures	Research phase			
		Design	**Case selection**	**Data gathering**	**Data analysis**
1	Reliability (demonstrates operations of the study and, if replicated, leads to same results)	-develop case study protocol -development and use of case study database	documentation of selection criteria in case study protocol case selection/ based on the study database	semi-structured interview-guide shared semi-structured interview guide with interviewees prior to the interview	rigorous coding process of transcripts using qualitative data analysis software involve researchers not involved in the data gathering process
2	Internal validity (establish a causal relationship, which is believed to lead to other outcomes/ conditions)	research model builds on previous literature and theoretical considerations (builds a theoretical framework for study)	expert interviews refining and acknowledging considerations sampling criteria noted in the case study protocol	most knowledgeable informants interviewed utilization of multiple sources of data	pattern matching of previous literature/ research triangulation of multiple sources of data
3	Construct validity (identification of suitable	building on and adapting previous research	not applicable	multiple sources of data (semi-structured	review of transcripts by key

	operational measures for the study)	questions in the field of sustainable supply chain management		interviews, sustainability reports, press articles, and reports)	informants/ interviewees
4	External validity (showcase generalizability of findings)	comparative multiple case studies	theoretical sampling	gathering data on the case context	tbd: details on case study context considered
Note: compiled by authors based on references Yin (2018), Gibbert et al. (2008)					

Research Design

To study which sustainability complexities firms face and to understand the underlying theoretical constructs in depth, we use an abductive multiple case study approach (Alexander et al., 2014; Dubois & Gadde, 2002; Dubois & Salmi, 2016; Locke et al., 2008; Siggelkow, 2007; Yin, 2018). This approach best fits for the following reasons. First, qualitative research on which sustainability complexities firms face remains scarce and fuzzy, which makes it possible to validate existing theoretical considerations. Therefore, the abductive approach guides our research process on the one side prior the data analysis as we rely on theoretical considerations. Conversely, it supports the data analysis in the collection phase and helps complement our understanding (Ketokivi & Choi, 2014). Second, the case study approach is best suited for investigating the phenomena in its natural setting. Contrary to a quantitative approach, it allows for the interaction between the researcher and the informant. It thereby draws on not just one source of information instead of relying on multiple data sources, which leads to higher information richness (Yin, 2018). Moreover, by studying the phenomena in its natural setting and drawing on insights from informants' statements, we can develop and modify a theoretical contribution of high practical relevance (Gibbert et al., 2008). Third, as the topic of sustainability remains unclear and the resulting understanding of complexity fuzzy, we ensure with interviewing informants the clarification of the terms and, subsequently, the internal validity of our study. Fourth, by utilizing and triangulating multiple data sources, we reduce the social desirability bias of sustainability firms usually applied by window-dressing or greenwashing (Carter & Easton, 2011; Crane, 1999). According to our abductive approach, our research is thereby guided by the theoretical considerations based on Social Systems Theory. Again, the Social Systems Theory assumes that systems increase their internal complexity and build up collaborative complexity with others to cope with environmental complexity. As we build on preliminary theoretical considerations but are, to the best of our knowledge, not aware of the research regarding our research objective, a priori hypotheses cannot be derived. This led to a pre-selection of interview questions related to the preliminary considerations adopted from previous research in the field of mostly SCM and SSCM (Gong et al., 2018; Mena et al., 2013; Meqdadi et al., 2017; Morali & Searcy, 2013; Scandelius & Cohen, 2016; Wolf, 2011; Zhang et al., 2017).

Theoretical sampling and case selection

The sampling was carried out twofold: looking for potential industries and selecting potential companies. In the following, we outline our theoretical sampling and case selection reasons.

First, in particular, industries relying on the natural habitat and produce or source agricultural products face high expectations but also pressures from various actors (e.g., customers, governments, and NGOs) to implement a sustainability agenda in their supply chains (Hartmann & Moeller, 2014; Lee & Kim, 2009; Maloni & Brown, 2006; van Tulder & Kolk, 2001; Yu, 2008).

Because of this pressure and awareness, we assume that these firms are more likely to improve their sustainability agendas, enabling us a higher generalizability of the empirical findings.

Second, firms that process and source agricultural products are typically criticized for their and their supplier's harm to the environment (e.g., deforestation or wastewater), but also for their harm on humans both related to processing and sourcing (e.g., child labour or working conditions) as well as living in the natural environment nearby (The Guardian, 2015; Hofmann et al., 2014). Climate change has recently moved up the agenda, with more and more customers and other stakeholders holding companies accountable for their sustainability management. In addition, firms operating in supply chains focusing on agricultural products face a high vertical and horizontal supply chain complexity (Wilhelm et al., 2016).

Third, assuming that these very different actors (e.g., customers, NGOs, governments) expect the firms and their suppliers to continuously improve their sustainability agenda and actions, we focused on a diverse set of firms out of the agricultural industry regarding their size (number of employees) and purchasing categories. This suits the qualitative approach, building on high variance and looking for differences between firms and their respective purchasing categories.

Fourth, we focused on firms based in and operating from Germany to increase the comparability of external factors like governmental regulations. To refine and further develop our sampling frame and the developed semi-structured interview guide, we engaged in expert interviews with for- and non-profit organizations prior to our data collection phase. For this end, we contacted a diverse set of organizations.

The interviewed for and non-profit organizations are very diverse in their size and purchasing categories. Prior to the interviews, we pre-selected one or two purchasing categories (e.g., cacao, palm oil, cotton) from each firm's sourcing portfolio and agreed upon with the according interviewee. A general criterion was that we supposed that the selected purchasing category was significant for their total revenues and typical for why the company is publicly well known.

Finally, we managed to interview 20 organizations and conducted 26 interviews. However, we sampled six purchasing categories/industries, which coincides nicely with Eisenhardt (1989) suggested sample size of 4-10 cases. For a detailed list of the pre-tests and interviews, please refer to Table 2 and Table 3.

TABLE 2. Overview of Cases & Interviews

Case/ Supply Chain	Organization	Head-count	Branch	Respondent position	Duration in (min.)	Interview type
Production/ retail textiles	For-profit 2	3,600	Textiles	Manager Supplier Management & Sustainability	40	Call
	For-profit 2	3,600	Textiles	Manager Supplier Management & Sustainability	90	Face-to-face
	For-profit 3	2,600	Textiles	Head of Sustainability	25	Call
	For-profit 3	2,600	Textiles	Head of Sustainability	75	Face-to-face
	For-profit 4	15,000	Textiles	Director Global Sustainability	35	Call
	For-profit 4	15,000	Textiles	Director Global Sustainability	45	Call
	For-profit 6	50	Textiles	General Manager	90	Face-to-face
	For-profit 6	50	Textiles	General Manager	35	Call
	For-profit 9	1,200	Textiles	Team Leader Corporate Responsibility	80	Video-Call

Production beverages	For-profit 8	141	Beverages	Manager Sustainability	90	Call
	For-profit 16	394	Beverages	Manager CSR	75	Face-to-face
	For-profit 18	1,700	Beverages	Head of Sustainability & Safety	50	Call
Retail food/ non-food	For-profit 5	4	Coffee	General Manager	20	Call
	For-profit 5	4	Coffee	General Manager	85	Face-to-face
	For-profit 10	33,437	Food	Head of CSR	60	Face-to-face
	For-profit 15	12,100	Food/ Non-food	Lead Manager Sustainability	80	Call
	For-profit 23	5,222	Food/ Non-food	Director Sustainability Strategy	100	Face-to-face
	For-profit 24	152,000	Food	Head of Corporate Responsibility	50	Face-to-face
Production/ retail cosmetics	For-profit 22	24,000	Cosmetics	Creative Buyer (Buyer sustainability)	110	Face-to-face
Production food	For-profit 11	1,600	Food	Manager Work Safety & Sustainability Management	60	Call
	For-profit 13	9,800	Ingredients	Manager Corporate Sustainability	30	Call
	For-profit 14	9,800	Ingredients	Manager Corporate Sustainability	20	Call
Production cleansing	For-profit 17	1,050	Chemistry	Head of Sustainability and Organizations Management	40	Call
Note: compiled by authors						

TABLE 3. Additional interviews for background information

Case/ Supply Chain	Organization	Head-count	Branch	Respondent position	Duration in (min.)	Interview type
Retail food/ non-food	For-profit 1	20	Coffee	General Manager	35	Call
Non-specific	Non-profit 1	2,000	Services	Manager Public Affairs	35	Call
Production/ Retail Timber	Non-profit 2	12	Timber	Manager Market Services	35	Call
Note: compiled by authors						

Data Collection

The multi-disciplinary and cross-functional management of sustainability in supply chains led to varying informants (CEO, sustainability manager, purchasing manager) in each case. Using a semi-structured interview guide, we sampled the cases between August 2019 and March 2020. We sent a shortened version of our semi-structured interview guide to the interviewees before our interview. We assumed that this improved the quality of our interviewees' answers as they had the chance to develop notes, drafts, and first ideas on our research questions. Furthermore, we expected to shape the interviewing process and enhance the flow of the interview conversation. We deepened our understanding and questions of the study objective based on the notes. During the course of the research, we refined and adjusted our semi-structured interview questions to ensure that we included new and interesting facets (Yin, 2018). In addition, interview questions from previous research in the field were revised and adopted (e.g., from Chen et al., 2004; Vachon

& Klassen, 2006; Zhu & Sarkis, 2004). With that step, we further increased the quality of our research and, in particular, our semi-structured interview guide. All the interviews were conducted in German and were assured of being treated anonymously. Therefore, the descriptions in the following tables include anonymized information only, which prevents tracing back to the firms. The interviews lasted 60 minutes on average and were carried out by one researcher. Prior to the interviews, we gained further information to follow the sampling step regarding the purchasing categories by using publicly available sources of information like corporate websites, sustainability reports, and supplier/supply chain codes of conduct. The audiotaped interviews were transcribed afterward. In total, we conducted 26 interviews with 20 organizations during the course of the research. Due to the unstructured information and, in part, missing audio material, we do not include the pre-tests in this study. However, we report them in this method section for the sake of completeness and, more importantly, see them as additional background information and interviews for further context (see table). However, this reduces the number of interviews included in the analysis section to 23 interviews with 17 different for-profit firms. During the interviews, notes were taken, and immediately after the interviews, these notes were added to a protocol (e.g., date of interview, information of interviewee, interview setting (face-to-face or phone call), and other comments). This accounts for reliability and supports the following data analysis (Gibbert et al., 2008; Yin, 2018). To ensure validity, we further collected information from multiple sources of data (sustainability reports, information from the firm website, supplier/supply chain code of conduct, press articles, and other reports freely accessible) for later triangulation (Gibbert et al., 2008). After the interview was transcribed, we shared the interview transcripts with the interviewees for verification and to ensure reliability (Ellram, 1996). No interviewee intervened or asked for changes in the statements. As a last step, we established a case database consisting of the transcripts, notes, and other sources of data for triangulation (Yin, 2018).

The data analysis consisted of two parts. First, the within-case analysis allows understanding case-specific sustainability complexities, whereas the cross-case analysis is utilized to identify sustainability complexities as patterns across the cases as commonalities.

The first step was to provide the within-case descriptions. This section aims to provide internally consistent descriptions of the cases. For that end, we try to capture all information relevant – the sustainability complexities.

Afterward, we executed open coding of our interviews. In that step, we also tried to arrange the codes in categories. This step was followed by axial coding, which supports the anchoring of the data analysis in theory. By that, it helps to refine the concept and leads to better reliability of the data.

In particular, we reviewed the data and looked for the sustainability complexities indicated in our literature review on Social Systems Theory. This step led to adjustments, e.g., economic sustainability was less relevant due to our pre-defined semi-structured interview guide, and ecological sustainability was split as it is more relevant to view it from a waste and emission perspective.

3. FINDINGS AND DISCUSSIONS

Within-case-analysis/Case Production/ Retail Textiles

Production and retail in the textile industry have a long history of sustainability complexities (e.g., the Rana Plaza collapse.) Due to this history and major incidents, the textile industry has gained a high interest from the public worldwide. To meet these sustainability complexities the industry has set up sustainability goals affecting all actors in its related supply chain. Due to its

relatively long and fragmented supply chain, we investigated a diverse set of firms ranging from small to large and multi-national firms. In addition, the firms are diverse in their position in the supply chain, as some of them rather have a connection to end-customers while others are instead in a business-to-business relationship as producers and retailers. Due to their relationship with customers and size, some of these firms are internationally well-known for their high-quality and prized premium products. Smaller firms, however, are at least famous in the German textile market. In total, we conducted nine interviews with five different firms.

From a generic perspective, we see a relatively low number of codes in the textile industry. From our point of view, this is because the textile industry has a long-standing history of sustainability, as it was the industry that sped up the discussion, in particular on human rights. The team leader of corporate responsibility of for-profit 9 said:

> *I'll start with the social challenges. This is an issue that companies have been working on for a very long time.*

However, in our analysis we see that ecological & social complexities are are even distributed showing that despite its long history the textile industry still working on all sustainability complexities. During the interviews, the Director of Global Sustainability of for-profit 4 states it like this:

> *In between, of course, there is still an area that is a black box for most companies. So I'll say social conditions at spinning mills, that's where we are now, that's where we're slowly getting to. There are now also initial projects to make the spinning sector a little better. But in between, there are still one or two stages of area setting, weaving, knitting and all the wet processing, which still need to be developed more.*

In addition, the General Manager of for-profit 6 calls it like this as well:

> *And the big problem is that there is still a great deal of concern, and many people are still doing this, that the whole issue of sustainability is being treated as a fig leaf. Greenwashing, and many, many people do it. And that's the problem, and I see it as being very widespread in our market. So that's one of the biggest problems.*

Zooming in the social complexity perspective, we see that, in particular, the issue of working conditions is of major interest and in focus of firms. The team leader corporate responsibility of for-profit 9 describes it as follows:

> *It is tough to make progress in this area [edit: social sustainability] in the countries where we work. Where we work. We really do work in high-risk countries. Bangladesh, Turkey, China. Simply because of the legal situation. It's difficult to measure.*

On the other hand, ecological issues are even distributed, showcasing that all problems are of concern currently. In particular, the Director of Global Sustainability of for-Profit four states that there are just a few issues regarding sustainability:

> *I mean the, the, the ecological and social challenges, we can count them on five fingers. So in the environmental area, it's the whole issue: resources, competition for land, exposure to harmful chemicals, the whole issue of water use and water utilization, the whole issue of climate and climate protection, the whole issue of plastics, microplastics, landfills, that kind of thing.*

Within-case-analysis/Case Retail Food/ Non-Food

Retail food and non-food is one of the biggest industries in Germany, too. Besides sourcing and selling German-crown food, the German market depends on many imported and non-food foods. This characteristic we kept within this case. Two of the firms are the largest food and non-food retailers in Germany, selling food products like fruits and wheat products but also some textiles and households. The other firms are known for their coffee retail business activities in

Germany. In particular, as this industry has a direct relationship with end customers and the public, its sustainability complexity awareness is high. In particular, customers increasingly rate the retailers not just regarding their sustainability activities but also specifically buy sustainable products. However, to get a broad overview of the industry, we conducted a set of interviews ranging from a tiny firm to huge firms. In total, we conducted six interviews with five different firms. This enables us to have a high contrast for analysis.

In our analysis, we see that the retail food & non-food industry has relatively many codes, indicating that there is a high focus and urgency to speak about the issue. From our point of view, this comes also from a customer perspective as these products are dealt with by customers on a daily basis, meaning that they have a high awareness. Customers do not only have a high understanding of the products themselves but also certain sustainability complexities. For-profit 5s General Manager states it like this:

> *Today, many consumers are aware that it is the top issue even before the climate crisis, which, of course, means: How do we deal with it now? Do we want to deal with - and this is, of course, a very fundamental question for the group - how do we deal with plastics now?*

In particular, this is the case for our interviewed firms as they are highly known in the market. Regarding the sustainability complexities we see an even distribution. However, social complexities, in particular, arise with coffee as a specific product. The Lead Manager of Sustainability of for-profit 15 exemplaries describes this in our interviews:

> *Another huge problem with coffee is that the coffee grower, i.e., the farmer, and the next instances have a totally shifted balance of power.*

This is highlighted by issues regarding people at the sourcing locations. Both the Lead Manager Sustainability of For-profit 15 and the Head of Corporate Responsibility of For-profit 24 state:

> *Our rule is that every factory that slips onto our portfolio has to be audited once, which means that the majority of them don't even get in, and we are extremely strict about this. And then, we set up a long-term social program in the factories with which we work, and we try to raise this to 100%, where the main focus is on solving the social problems in the factory.*
>
> *Yes, the issue of indigenous peoples is, of course, closely linked. In other words, the expulsion of indigenous peoples who used to live in those same primeval forests. But of course, there is also the issue of human rights in the supply chain, i.e., working conditions, safety, health, and safety measures. This is an incredibly critical challenge, which has already been partially addressed, including in the commodities we have just discussed.*

On the other hand, ecological complexities are less specific. In our analysis, we see an even distribution.

Within-case-analysis/Case Production Food

In contrast to the retail food and non-food industry, there is a limited number of German-producing food firms in terms of revenue volume. However, the German market has some internationally operating and selling firms. Due to this fact, the firms are both of interest for sustainability complexities internationally and in Germany. In this case, we tried to copy this market structure and interest in sustainability complexities. We conducted three interviews with two different firms. One of these firms is internationally well-known for its chocolate, and the other, in contrast, is less known but one of a small group of ingredient providers. In this case, we contrast, in particular, the publicly known firms and their position in the supply chain.

The food production industry has a high number of codes as well. From our point of view, this

is due to the fact that food has a high awareness as it is a product which customers deal with daily. In particular, as the products come from the global south where sustainability complexities are known to Western customers. The high amount of codes also signals the high awareness of the firms we interviewed in the market. The high awareness is also seen in the sustainability complexities identified. We see an even distribution of ecological & social complexities. However, impact as a keyword was striking in our analysis. From our point of view, using the keyword impact and its synonyms is due to the intrinsic awareness the firms have as well as the awareness the market gives them. For example, the Manager of Work Safety & Sustainability Management of for-profit 11 said:

> *We would have no opportunity because the quantities we source are far too small, even though this is our main raw material. That's exactly the challenge that everyone says you have to be there. Yes, I like to say that, but the problem is that if I cough, someone has to get a sniffle. Because if that doesn't happen, I have no impact.*

In addition, the Manager of Work Safety & Sustainability Management of for-profit 11 said:

> *Because we think the actions it takes are important and we are represented there by the Central Association of the Food Industry. That's how we see ourselves represented there because they also have an impact.*

On the contrary, the Manager Corporate Sustainability of for-profit 13 highlight impact as a keyword as he said:

> *This is recorded in the scorecard, which is why there are no ecological or health impacts of raw materials.*

Within-case-analysis/Case Production Beverages

Beverages and their production are of high interest as Germany has a very diverse but high-volume beer industry. In addition, the German market has some well-known non-alcoholic beverages firms. These German-market-specifics are expressed in this case. In particular, the beverages industry is fascinating as the sourced ingredients are either sourced internationally or even pre-produced at their source of origin, placing sustainability complexities internationally and in Germany on the public agenda. Besides this fact, the further refinement is quite energy intensive (e.g., for cooling and heating processes), and the logistics of the goods is a major sustainability complexity as well. Three interviews with three different and well-known German firms were conducted to build up knowledge.

The beverages industry has a rather

limited amount of codes. From our point of view, it is not directly regarded as a sustainability complexity issue but instead included in foods overall. However, the history of sustainability complexities is quite short, so we argue that the problems will rise, too.

Looking in particular in the sustainability complexities, we see an almost even distribution between ecological and social complexities too. However, as there are no focus issues in social complexities, we see a focus in environmental issues like emissions and waste. The Manager CSR of For-profit 16 specifies it like this:

> *So, there are two topics that are currently super-hot topics: the one is the climate, and the other is the packaging.*

Within-case-analysis/Case Production/ Retail Cosmetics

In recent years, the cosmetics industry has gained awareness due to its critical sourced ingredients. In addition, due to its direct use on the skin, customers are increasingly concerned about the ingredients and their skin effects and environmental impacts, e.g., micro-plastics. However, as the market is very fragmented due to the product portfolio, we focused on conducting

interviews with large firms only. For the cosmetics industry, we got the chance to interview one of the most well-known cosmetics and daycare firms worldwide. In addition, this firm is internationally known for its high engagement regarding sustainability complexity, focusing on the products naturally ingredients both, protecting people, customers, and the environment.

The cosmetics industry is of high relevance to sustainability complexities. In particular, in our analysis, we see that supported by the brand awareness of our interviewed firm. This high awareness was noticed due to quite a lot of codes regarding sustainability complexities. In particular, one statement of the Creative Buyer (Buyer sustainability) of For-profit 22 shows that the high awareness of sustainability comes from inside due to a lot of environmental activists in the firm:

> *So, the fact that pesticides are an issue certainly comes from the environmental activists in the company. Well, we have many activists in the company, it has to be said.*

In addition, the interviewee proportionally said more regarding ecological rather than social complexities. However, the ecological issues are even distributed.

Within-case-analysis/Case Production Cleansing

Similar to the cosmetics industry, the cleansing industry is also highly focused on. In particular, the cleaning industry is focused on as their products have a high impact on the environment and the user's skin/body due to potentially hazardous ingredients. Due to this fact, we were able to interview one of Germany's most well-known firms regarding environmentally friendly cleaning products.

The production of cleansing products has a relatively low amount of codes. From our point of view, this is due to the rather limited size of the market. In addition, the firm we interviewed is well known for its sustainability complexity initiatives and performance. When asking the Head of Sustainability and Organizations Management of For-Profit 17 about possible partners to cooperate with regarding sustainability, they said:

> *Well, the thing is that For-Profit 17 is a medium-sized company and we are relatively alone in that respect, at least as far as our sustainability standards are concerned. That means that what the big players do, in this case [examples of peer-group firms], is nowhere near what we want, and that's why we haven't really seen any partners that we could team up with, at least not from the same industry.*

This could be an indication that the firm did not exaggerate the sustainability complexities. However, we see that only ecological complexities exist for the interviewee. One explanation for the missing social complexities is that the cleaning products industry is highly integrated in chemicals utilization. This issue is rather concerned with ecological impacts than, as by now, with social issues.

Within-case-analysis/Discussion & Cross-Case Analysis

This section presents the discussion & cross-case analysis while comparing it to the existing literature. To answer our research question, this section summarizes the constructs of the social systems theory utilizing the case description and cross-case analysis.

As expected, all firms in our sampling approach actively managed sustainability in their supply chains. All firms therefore regarded sustainability as a very important issue in their supply chains and actively worked on that. However, we observed differences in how these firms view sustainability complexities in their supply chains.

While all investigated firms view sustainability and the resulting sustainability complexities in their supply chains as very important issues, they differently weigh it in their views. In some

cases, they tend to focus on ecological sustainability complexities, while in others cases firms focus primarily on social sustainability complexities.

In order to identify patterns in the view of sustainability complexities, we compared the cases for similarities and differences to enable a contrastive analysis.

We reorganized cases according to industry branches that we linked to supply chain archetypes (e.g., production and retail of textiles) (Mena et al., 2013; Tachizawa & Wong, 2014).

Based on our preliminary conceptualization and emerging themes, we could compare the cases in terms of their sustainability complexities (ecological VS social). We will explain these patterns in the following and extend the discussion based on our coded information.

As expected, sustainability complexities are relatively equally distributed across the cases. However, we found two exceptions. In the case of production/ retail cosmetics and production cleansing firms, they view more ecological sustainability complexities than social sustainability complexities. In particular, in the case of Production/ retail cosmetics, we would have expected an equal weight of the sustainability complexities due to the similarity of cases to food or textiles. We would have expected similarity due to the products as, in both cases, products are directly used for the body either as an intake or dressing. From our point of view, we explain the overweight in these cases from a sustainability awareness perspective. Ecological sustainability complexities and their resulting impacts directly emerge on a rather global level. This is, e.g., the case for global warming effects but also ocean heating and rising sea levels. Contrary to that, and hard to say, social sustainability complexities and their resulting impact mostly occur exclusively on a local level. Because of this effect, the discussions regarding ecological sustainability complexities predominantly occur in public and on a global level rather than in discussions regarding social sustainability complexities.

Another interesting pattern emerged is the rather dominant view of social sustainability complexities in the case of Production/ retail textiles and case of Retail food/ non-food but less in the case of Production beverages or case of Production/ retail cosmetics. From our point of view, this is interesting as these cases are dealing with natural products and therefore show a similarity. However, we explain these differences due to the visibility and history of the industries. As textiles and coffee (beans) are non-food products, they appear very prominent in public discussions. Contrary to these discussions, the beverage industry still revolves around ecological sustainability complexities.

When comparing the cases (respective industries), we can summarize that overweight regarding codes emerge in highly visible or historically younger industries like Retail food/ non-food, Production/ retail cosmetics, and Production food. In particular, we argue that the textile industry is an obvious industry resulting from e.g., Rana Plaza incident, chemicals utilization during production processes, but also as textiles are worn daily, particularly for fashion purposes. On the contrary, Production/ retail cosmetics could be seen as a relatively historically younger industry as cosmetics and frequent use is a rather young phenomenon even though cosmetics are not daily used as compared to the case of textiles.

5. CONCLUSIONS

This research enhances the knowledge of sustainability complexities in supply chains and its overarching theme of SSCM. Investigating sustainability in supply chains empirically provides a novel perspective utilizing social systems theory.

Based on the discussion and cross-case analysis conducted in this study, it is evident that sustainability is a concern for firms in managing their supply chains. All the firms included in our sampling approach regarded sustainability as a crucial issue and actively engaged in sustainable practices within their supply chains. However, there were notable differences in how these firms perceived and prioritized sustainability complexities.

Our analysis revealed that while all investigated firms recognized the importance of sustainability in their supply chains, their focus varied. Some firms emphasize ecological sustainability complexities, while others prioritize social sustainability complexities. This differential view shows that firms approach sustainability from different perspectives based on their industry, visibility to and in the market, and historical context.

By comparing industry branches linked to supply chain archetypes, we identified patterns in the distribution of sustainability complexities. Industries such as the production and retail of textiles and retail food/non-food exhibited a dominant view of social sustainability complexities, whereas the production of beverages or cosmetics showed a greater emphasis on ecological sustainability complexities.

In conclusion, these findings show the need for firms to adopt a holistic approach to sustainability management, considering both ecological and social dimensions. Moreover, firms should recognize the influence of visibility and historical context on sustainability priorities and adapt their strategies accordingly.

Based on the findings of our study, several managerial implications and recommendations can be derived to help firms effectively address sustainability complexities in their supply chains.

First, firms should adopt a balanced approach to address both ecological and social sustainability complexities. This means that firms should not only integrate sustainability in their operational processes but start at the top and integrate sustainability in their overarching strategy.

Second, firms should acknowledge the influence of industry visibility and historical context on their sustainability priorities. This acknowledgment comes from consideration and acknowledgment of the firms' respective stakeholders.

Third, based on the acknowledgment and visibility of the firms' respective stakeholders, firms should consider collaboration with stakeholders to implement sustainable practices and drive positive change in their supply chains externally but also internally.

And last, by continuously monitoring and evaluating sustainability performance, firms enable themselves to identify areas for improving their sustainability performance and innovations of their respective business models.

This paper makes the following contributions. First, to the best of our knowledge, this paper might be the first to utilize social systems theory in the context of sustainable supply chain management. By doing so, we enhance our knowledge of the field.

Second, this paper empirically investigates sustainability complexities in supply chains. To reduce sustainability complexities, firms need to view and understand their relevant sustainability complexities first. By that, they take the first step to stay viable and continue participating in the market.

Third, besides our theoretical contributions, this paper also has managerial implications. By utilizing the social systems theory, we adopt a rather organizational view providing firms identify themselves with. Firms can use our research as a starting point for identifying sustainability complexities and coping with them.

This paper also has limitations and provides future research directions as well. First, as this paper empirically investigates sustainability complexities with a multiple-case study on agricultural firms there might be shortcomings in the identified sustainability complexities. As industries might view sustainability complexities differently, we call for further qualitative research utilizing multiple-case study methodology. By that future research can extend the knowledge of the field.

Second, as this paper relies on a case study methodology, it is by far not exhaustive in data. This shortcoming also constraints the generalization of the findings. However, future research could apply quantitative studies to test and refine the results. For that, large sample studies could be used.

Third, as we only focus on a certain scope of firms and time, there might be changes of which sustainability complexities firms view. In particular, this could be the case regarding the development of firms in their context. We could imagine, that firms might view different sustainability complexities while grow in size, but also in terms of time. For example, due to the change of public concerns we can imagine that years ago first ecological sustainability complexities were relevant while in the future more social sustainability complexities are relevant for firms.

Fourth, we call for further application of social systems theory in the context of sustainable supply chains management. As highlighted in the beginning of the paper, we argue that social systems theory might be a valuable theoretical basis for investigating sustainability in supply chains as it provides a modern complexity perspective, which perfectly fits in an increased complex world.

AUTHOR CONTRIBUTION

Writing – original draft: Alexander Neske, Ilona Bordiyanu, Christian Brauweiler.
Conceptualization: Alexander Neske, Ilona Bordiyanu, Christian Brauweiler.
Formal analysis and investigation: Alexander Neske, Ilona Bordiyanu, Christian Brauweiler.
Funding acquisition and research administration: Alexander Neske , Ilona Bordiyanu, Christian Brauweiler.
Development of research methodology: Alexander Neske, Ilona Bordiyanu, Christian Brauweiler.
Resources: Alexander Neske, Ilona Bordiyanu, Christian Brauweiler.
Software and supervisions: Alexander Neske, Ilona Bordiyanu, Christian Brauweiler.
Data collection, analysis and interpretation: Alexander Neske, Ilona Bordiyanu, Christian Brauweiler
Visualization: Alexander Neske, Ilona Bordiyanu, Christian Brauweiler.
Writing review and editing research: Alexander Neske, Ilona Bordiyanu, Christian Brauweiler.

References

1. Adler, P., Du Gay, P., Morgan, G., Reed, M., Seidl, D., & Mormann, H. (2014). Niklas Luhmann as Organization Theorist. In P. Adler, P. Du Gay, G. Morgan, & M. Reed (Eds.), *The Oxford Handbook of Sociology, Social Theory, and Organization Studies.* Oxford University Press.
2. Alexander, A., Walker, H., & Naim, M. (2014). Decision theory in sustainable supply chain management: A literature review. *Supply Chain Management: An International Journal, 19*, 504–522. https://doi.org/10.1108/SCM-01-2014-0007
3. Ashby, W. R. (1957). An Introduction to Cybernetics. *Chapman & Hall LTD.*
4. Baumann-Pauly, D., C. Wickert, L. J. Spence, & Scherer, A. G. (2013) Organizing Corporate Social Responsibility in Small and Large Firms: Size Matters. *Journal of Business Ethics, 115*, 693–705. https://doi.org/10.2139/ssrn.1974194
5. Benbasat, I., Goldstein, D. K., & Mead, M. (1987). The Case Research Strategy in Studies of Information Systems. *Management Information Systems Quarterly*, *11*(3), 369–386. https://doi.org/10.4135/9781849209687.n5
6. Carter, C. R., & Easton, P. L. (2011). Sustainable supply chain management: Evolution and future directions. *International Journal of Physical Distribution & Logistics Management, 41*(1), 46–62. https://doi.org/10.1108/09600031111101420
7. Chen, I. J., Paulraj, A., & Lado, A. A. (2004). Strategic purchasing, supply management, and firm performance. *Journal of Operations Management*, *22*(5), 505–523. https://doi.org/10.1016/j.jom.2004.06.002
8. Choi, T. Y., Dooley, K. J., & Rungtusanatham, M. (2001). Supply networks and complex adaptive systems: control versus emergence. *Journal of Operations Management, 19*, 351–366. https://doi.org/10.1016/S0272-6963(00)00068-1
9. Crane, A. (1999). Are You Ethical? Please Tick Yes or No: On Researching Ethics in Business Organizations. *Journal of Business Ethics, 20*, 237–248.

10. Daft, R. L., & Lengel, R. H. (1986). Organizational Information Requirements, Media Richness, and Structural Design. *Management Science, 32*(5), 554–571. https://doi.org/10.1287/mnsc.32.5.554
11. Damanpour, F. (1996). Organizational Complexity and Innovation: Developing and Testing Multiple Contingency Models. *Management Science, 42*(5), 693–716.
12. Dou, Y., Zhu, Q. & Sarkis, J. (2018). Green multi-tier supply chain management: An enabler investigation. *Journal of Purchasing and Supply Management, 24*(2), 95–107. https://doi.org/10.1016/j.pursup.2017.07.001
13. Dubois, A., & Gadde, L.-E. (2002). Systematic combining: an abductive approach to case research. *Journal of Business Research, 55*, 553–560. https://doi.org/10.1016/S0148-2963(00)00195-8
14. Dubois, A., & Salmi, A. (2016). A call for broadening the range of approaches to purchasing and supply management case studies. *Journal of Purchasing and Supply Management, 22*(4), 247–249. https://doi.org/10.1016/j.pursup.2016.09.002
15. Eisenhardt, K. M. (1989). Building Theories from Case Study Research. *The Academy of Management Review, 14*(4), 532–550.
16. Ellram, L. M. (1996). The use of the Case Study Method in Logistics Research. *Journal of Business Logistics, 17*(2), 93–138.
17. Gibbert, M., Ruigrok, W., & Wicki, B. (2008). What passes as a rigorous case study? *Strategic Management Journal, 29*(13), 1465–1474. https://doi.org/10.1002/smj.722
18. Gong, Y., Jia, F., Brown, S., & Koh, L. (2018). Supply chain learning of sustainability in multi-tier supply chains. *International Journal of Operations and Production Management, 38*(4), 1061–1090. https://doi.org/10.1108/IJOPM-05-2017-0306
19. Grimm, J. H., Hofstetter, J. S. & Sarkis, J. (2014). Critical factors for sub-supplier management: A sustainable food supply chains perspective. *International Journal of Production Economics, 152*, 159–173. https://doi.org/10.1016/j.ijpe.2013.12.011
20. Grimm, J. H., Hofstetter, J. S., & Sarkis, J. (2016). Exploring sub-suppliers' compliance with corporate sustainability standards. *Journal of Cleaner Production, 112*, 1971–1984. https://doi.org/10.1016/j.jclepro.2014.11.036
46. The Guardian. (2015). Stop eating Nutella and save the forests, urges French ecology minister. Available online: https://www.theguardian.com/environment/2015/jun/17/stop-eating-nutella-and-save-the-forests-urges-french-ecology-minister
21. Hall, J., Matos, S., & Silvestre, B. (2012). Understanding why firms should invest in sustainable supply chains: A complexity approach. *International Journal of Production Research, 50*(5), 1332–1348. https://doi.org/10.1080/00207543.2011.571930
22. Hartmann, J., & Moeller, S. (2014). Chain liability in multitier supply chains? Responsibility attributions for unsustainable supplier behavior. *Journal of Operations Management, 32*, 281–294. https://doi.org/10.1016/j.jom.2014.01.005
23. Hofmann, H., Busse, C., Bode, C., & Henke, M. (2014). Sustainability-Related Supply Chain Risks: Conceptualization and Management. *Business Strategy and the Environment, 23*(3), 160–172. https://doi.org/10.1002/bse.1778
24. Jia, F., Gong, Y., & Brown, S. (2019). Multi-tier sustainable supply chain management: The role of supply chain leadership. *International Journal of Production Economics, 217*, 44–63. https://doi.org/10.1016/j.ijpe.2018.07.022
25. Kauffman, S. A. (1991). The Sciences of Complexity and "Origins of Order". *Philosophy of Science Association, 2*, 239–247. https://doi.org/10.1007/978-1-84882-525-3_25
26. Ketokivi, M., & Choi, T. Y. (2014). Renaissance of case research as a scientific method. *Journal of Operations Management, 32*(5), 232–240. https://doi.org/10.1016/j.jom.2014.03.004
27. Lee, K.-H., & Kim, J.-W. (2009). Current status of CSR in the realm of supply management: The case of the Korean electronics industry. *Supply Chain Management: An International Journal, 14*(2), 138–148. https://doi.org/10.1108/13598540910942000
28. Levinthal, D. A., & Warglien, M. (1999). Landscape Design: Designing for Local Action in Complex Worlds. *Organization Science, 10*(3), 342–357. https://doi.org/10.1287/orsc.10.3.342
29. Locke, K., Golden-Biddle, K., & Feldman, M. S. (2008). Perspective—Making Doubt Generative: Rethinking the Role of Doubt in the Research Process. *Organization Science, 19*(6), 907–918. https://doi.org/10.1287/orsc.1080.0398

30. Luhmann, N. (1995). *Social Systems*. Stanford University Press.
31. Maloni, M. J., & Brown, M. E. (2006). Corporate social responsibility in the supply chain: An application in the food industry: Corporate social responsibility in the supply chain: An application in the food industry. *Journal of Business Ethics*, *68*(1), 35–52. https://doi.org/10.1007/s10551-006-9038-0
32. Matos, S., & Hall, J. (2007). Integrating sustainable development in the supply chain: The case of life cycle assessment in oil and gas and agricultural biotechnology. *Journal of Operations Management*, *25*(6), 1083. https://doi.org/10.1016/j.jom.2007.01.013
33. Mena, C., Humphries, A., & Choi, T. Y. (2013). Toward a Theory of Multi-Tier Supply Chain Management. *Journal of Supply Chain Management*, *49*(2), 58–77. https://doi.org/10.1111/jscm.12003
34. Meqdadi, O., Johnsen, T. E., & Johnsen, R. E. (2017). The role of power and trust in spreading sustainability initiatives across supply networks: A case study in the bio-chemical industry. *Industrial Marketing Management*, *62*, 61–76. https://doi.org/10.1016/j.indmarman.2016.06.006
35. Meredith, J. (1998). Building operations management theory through case and field research. *Journal of Operations Management*, *16*(4), 441–454. https://doi.org/10.1016/S0272-6963(98)00023-0
36. Mohe, M., & Seidl, D. (2011). Theorizing the client—consultant relationship from the perspective of social-systems theory. *Organization*, *18*(1), 3–22. https://doi.org/10.1177/1350508409353834
37. Morali, O., & Searcy, C. (2013). A Review of Sustainable Supply Chain Management Practices in Canada. *Journal of Business Ethics*, *117*(01674544). https://doi.org/10.1007/s10551-012-1539-4
38. Muñoz-Torres, M. J., Fernández-Izquierdo, M. A., Ferrero-Ferrero, I., Escrig-Olmedo, E. & Rivera-Lirio, J. M. (2023). Social Life Cycle Analysis of Textile Industry Impacts for Greater Social Sustainability of Global Supply Chains. *Systems*, *11*(8), 1-19. https://doi.org/10.3390/systems11010008
39. Pathak, S. D., Day, J. M., Nair, A., Sawaya, W. J., & Kristal, M. M. (2007). Complexity and Adaptivity in Supply Networks: Building Supply Network Theory Using a Complex Adaptive Systems Perspective. *Decision Sciences*, *38*(4), 547–580. https://doi.org/10.1111/j.1540-5915.2007.00170.x
40. Rasche, A., F. G. A. De Bakker & Moon, J. (2013). Complete and Partial Organizing for Corporate Social Responsibility. *Journal of Business Ethics*, *115*, 651–663. https://doi.org/10.1007/s10551-013-1824-x
41. Reinecke, J. & Ansari, S. (2016). Taming Wicked Problems: The Role of Framing in the Construction of Corporate Social Responsibility. *Journal of Management Studies*, *53*(3), 299–329. https://doi.org/10.1111/joms.12137
42. Reiskin, E. D., White, A. L., Johnson, J. K., & Votta, T. J. (1999). Servicizing the Chemical Supply Chain. *Journal of Industrial Ecology*, *3*(2/3), 19–31. https://doi.org/10.1162/108819899569520
43. Sarkis, J., & Zhu, Q. (2018). Environmental sustainability and production: taking the road less travelled. *International Journal of Production Research*, *56*(1/2), 743. https://doi.org/10.1080/00207543.2017.1365182
44. Sarkis, J., Santibanez Gonzalez, E., & Koh, S. L. (2019). Effective multi-tier supply chain management for sustainability. *International Journal of Production Economics*, *217*, 1–10. https://doi.org/10.1016/j.ijpe.2019.09.014
45. Sarkis, J [Joseph], & Zhu, Q [Qingyun] (2018). Environmental sustainability and production: taking the road less travelled. *International Journal of Production Research*, *56*(1/2), 743–759. https://doi.org/10.1080/00207543.2017.1365182
46. Scandelius, C., & Cohen, G. (2016). Achieving collaboration with diverse stakeholders—The role of strategic ambiguity in CSR communication. *Journal of Business Research*, *69*(9), 3487–3499. https://doi.org/10.1016/j.jbusres.2016.01.037
47. Schneider, A., Wickert, C., & Marti, E. (2017). Reducing Complexity by Creating Complexity: A Systems Theory Perspective on How Organizations Respond to Their Environments. *Journal of Management Studies*, *54*(2), 182–208. https://doi.org/10.1111/joms.12206
48. Schuh, G., Sauer, A., & Döring, S. (2006). Managing Complexity in Industrial Collaborations Within Tool & Die Industry. In IFIP International Federation for Information Processing. *Information*

Technology For Balanced Manufacturing Systems, *220*,167–174.Boston, MA: Springer US. https://doi.org/10.1007/978-0-387-36594-7_18
49. Seidl, D., & Becker, K. H. (2006). Organizations as Distinction Generating and Processing Systems: Niklas Luhmann's Contribution to Organization Studies. *Organization*, *13*(1), 9–35. https://doi.org/10.1177/1350508406059635
50. Siggelkow, N. (2007). Persuasion with Case Studies. The Academy of Management Journal, 50(1), 20–24. https://doi.org/10.5465/AMJ.2007.24160882
51. Simon, H. A. (1962). The Architecture of Complexity. *Proceedings Ofthe American Philosophical Society*, *106*(6), 467–482.
52. Sousa, J. C. de, Alves, M. B., Leocádio, L., & Rossato, J. (2019). Environmental Management of Larg Supply Chain: A Diagnostic Instrument Proposed for Assessing Suppliers. *Brazilian Business Review*, *16*(6), 537–554. https://doi.org/10.15728/bbr.2019.16.6.1
53. Stuart, I., McCutcheon, D., Handfield, R., McLachlin, R., & Samson, D. (2002). Effective case research in operations management: a process perspective. *Journal of Operations Management*, *20*, 419–433. https://doi.org/110.1016/S0272-6963(02)00022-0
54. Tachizawa, E. M., & Wong, C. Y. (2014). Towards a theory of multi-tier sustainable supply chains: A systematic literature review. *Supply Chain Management: An International Journal*, *19*(5/6), 1–37. https://doi.org/110.1108/SCM-02-2014-0070
55. Taylor, K. M., & Vachon, S. (2018). Empirical research on sustainable supply chains: IJPR's contribution and research avenues. *International Journal of Production Research*, *56*(1-2), 950–959. https://doi.org/110.1080/00207543.2017.1402139
56. Vachon, S., & Klassen, R. D. (2006). Extending green practices across the supply chain. International *Journal of Operations & Production Management*, *26*(7), 795–821. https://doi.org/10.1108/01443570610672248
57. van Tulder, R., & Kolk, A. (2001). Multinationality and corporate ethics: codes of conduct in the sporting goods industry. *Journal of International Business Studies*, *32*(2), 267–283. https://doi.org/110.1057/palgrave.jibs.8490952
58. Wilhelm, M., Blome, C., Bhakoo, V., & Paulraj, A. (2016). Sustainability in multi-tier supply chains: Understanding the double agency role of the first-tier supplier. *Journal of Operations Management*, *41*. https://doi.org/10.1016/j.jom.2015.11.001
59. Wilhelm, M., Blome, C., Wieck, E., & Xiao, C. Y. (2016). Implementing sustainability in multi-tier supply chains: Strategies and contingencies in managing sub-suppliers. International Journal of Production Economics, 182, 196–212. https://doi.org/10.1016/j.ijpe.2016.08.006
60. Wolf, J. (2011). Sustainable Supply Chain Management Integration: A Qualitative Analysis of the German Manufacturing Industry. *Journal of Business Ethics*, *102*(2). https://doi.org/10.1007/s10551-011-0806-0
61. Wright, S. (1932). The roles of mutation, inbreeding, crossbreeding, and selection in evolution. In D. F. Jones (Ed.), VI International Congress on Genetics, 356–366.
62. Yardley, J. A., Kauffman, N. L., Cairney, T. D., & Albrecht, W. D. (1992). Supplier behavior in the U.S. Audit market. *Journal of Accounting Literature*, *11*, 151. Available online: https://search.proquest.com/docview/216311734?accountid=33964
63. Yang, Y., Jiang, Y., Jia, F. & Chen, L. (2023). The Impact of Supplier Instability on Corporate Social Responsibility Performance over the Firm Lifecycle: A Social Systems Theory Perspective. *British Journal of Management*, *34*, 1259–1281. https://doi.org/10.1111/1467-8551.12651
64. Yin, R. K. (2018). Case study research and applications: Design and methods (Sixth edition). SAGE.
65. Yu, X. (2008). Impacts of Corporate Code of Conduct on Labor Standards: A Case Study of Reebok's Athletic Footwear Supplier Factory in China. *Journal of Business Ethics*, *81*(3), 513–529. https://doi.org/10.1007/s10551-007-9521-2
66. Zhang, M., Pawar, K. S., & Bhardwaj, S. (2017). Improving supply chain social responsibility through supplier development. *Production Planning & Control*, *28*(6-8), 500–511. https://doi.org/10.1080/09537287.2017.1309717
67. Zhao, K., Zuo, Z., & Blackhurst, J. V. (2019). Modelling supply chain adaptation for disruptions: An empirically grounded complex adaptive systems approach. *Journal of Operations Management*, *65*(2), 190–212. https://doi.org/10.1002/joom.1009

68. Zhu, Q., & Sarkis, J. (2004). Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises. *Journal of Operations Management, 22*(3), 265–289. https://doi.org/10.1016/j.jom.2004.01.005

AUTHOR BIOGRAPHIES

***Alexander Neske** – M.S.c., Westsächsische Hochschule Zwickau University of Applied Sciences, Zwickau, Germany. Email: alexander.neske@outlook.com

Ilona Bordiyanu – PhD, Kazakh-American Free University, Ust-Kamenogorsk, Kazakhstan. Email: bordiyanuilona@mail.ru, ORCID ID: https://orcid.org/0000-0002-7175-9829

Christian Brauweiler – PhD, Associate Professor, Westsächsische Hochschule Zwickau University of Applied Sciences, Zwickau, Germany. Email: Christian.Brauweiler@fh-zwickau.de, ORCID ID: https://orcid.org/0000-0002-7175-9829